NOTES ON THE YELLOWJACKET PARASITE *BAREOGONALIS CANADENSIS* (HYMENOPTERA: TRIGONALIDAE)[1,2]

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ABSTRACT: *Bareogonalis canadensis* (Harrington) is recorded for the first time from colonies of *Vespula vulgaris* (L.) and *V. acadica* (Sladen). Emerging parasites are chased or forcibly removed from the nest by workers, but are apparently unharmed. Trigonalids reared in reproductive cells are larger and have one more antennal segment than those reared in worker cells.

The family Trigonalidae is represented by 4 species in America north of Mexico (Carlson, 1979). All are parasitic. In most cases eggs are laid along the periphery of the undersides of leaves where they are ingested by a foliage feeding intermediate host, usually a larval lepidopteran. Although the eggs hatch inside these caterpillars, the first instars do not develop until the intermediate host is further parasitized by another hymenopteran or dipteran, or predated upon by a social hymenopteran. In the latter case, trigonalid development begins when the caterpillar is fed to the wasp larvae by workers. Further information on the biology of this group is available in Clausen (1929, 1931, 1940), Cooper (1954), Malyshev (1968), and Carlson (1979).

Bareogonalis canadensis (Harrington) was recorded by Harrington (1896) as parasitizing the social vespid *Vespa occidentalis* Cresson [=*Vespula pensylvanica* (Saussure)] in southwestern British Columbia. In all probability, though, because of the aerial location of the nest from which *B. canadensis* was collected, and the presence of a second smaller species of parasitic hymenopteran [probably *Sphecophaga vesparum burra* (Cresson) (Hymenoptera: Ichneumonidae)] we believe that Harrington actually collected *B. canadensis* from a nest of *Dolichovespula arenaria* (Fab.), the aerial yellowjacket. *S. vesparum burra* is the only common yellowjacket parasite in the Pacific Northwest and is occasionally found in the nests of *D. arenaria* (MacDonald et al., 1975; Greene et al., 1976). It is rare in

[1]Received September 11, 1980.

[2]Scientific paper number 5737, Washington State University, College of Agriculture Research Center, Department of Entomology, Pullman 99164. Work conducted under projects 4037 and 0037. Financed in part by National Science Foundation Grant BNS 76-81400.

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colonies of the subterranean nesting *V. pensylvanica*. *B. canadensis* has also been collected from northwestern California by Stage and Slobodchikoff (1962) from a *D. arenaria* nest and from 2 colonies of *Vespula pensylvanica* from Gabriola Island, British Columbia (Taylor, 1898).

Collections

From 1974-1980, 170 colonies of *D. arenaria*, 197 of *V. pensylvanica*, 43 of *Vespula vulgaris* (L.) and 10 of *Vespula acadica* (Sladen) were collected from various locations in Idaho and Washington without encountering this parasite. However, on 3 August 1979, colonies of *V. vulgaris* and *V. acadica* with nests containing the parasite were collected from an east-facing slope of a grand fir [*Abies grandis* (Douglas) Lindl.] and western red cedar (*Thuja plicta* Donn) forest in Latah County, Idaho. Both colonies were located in the same decayed log with nest entrances 92 cm apart. The *V. acadica* combs were brought into the laboratory and placed into containers to collect emerging individuals. The *V. vulgaris* nest was placed into an observation box and screenhouse as described in Akre et al. (1973).

From the *V. acadica* nest 3 pupae of *B. canadensis* were obtained: 2 males and one pupa unidentifiable as to sex. Specimens of *B. canadensis* were first collected from the combs of *V. vulgaris* on 8 August. As of 21 August, 4 male and 1 female specimens had emerged. Final examination of the combs shortly thereafter revealed 8 additional trigonalid pupae (6 males and 2 females) and one prepupa.

On 13 September, a second *V. vulgaris* colony was collected from a log within 3 m of where the other parasitized colonies had been collected. Again, combs from the nest were placed into a container to collect emerging wasps. Seventeen male and 24 female *B. canadensis* were obtained from this nest. In all 3 cases, the colonies were also parasitized by the ichneumonid *Sphecophaga vesparum burra*.

Behavioral Interactions

Mature trigonalid larvae constructed thick (.4 mm) white styrofoam-like pupal caps just underneath the thin (.08 mm) pupal caps of *V. vulgaris*. Emerging trigonalids cut round holes approximately half the diameter of these caps. Normally, the cap remnants of *V. vulgaris* are removed by the workers immediately after emergence. New eggs are laid in these cells by the queen in 20 minutes or less. However, cells from which *B. canadensis* emerged had no significant cap remnants removed by workers until 5-6 days later, when with just the edge of the caps remaining, the queen again laid eggs into the cells.

Observations showed that although newly emerged *B. canadensis* adults were either chased out or forcibly removed by workers from the *vulgaris* colony, they usually escaped unharmed. In one case, a *B. canadensis* chewed out of its pupal cell but was relatively unnoticed by a worker which was inspecting adjacent cells. Once out of the cell the parasite was antennated by a worker and then ignored. Eventually the parasite was attacked by a worker which flipped it over using her mandibles and then left it. Within the next few minutes workers attacked the parasite twice in a similar fashion. Approximately 12 minutes after emergence, the parasite was carried outside the nest by a worker. Workers were never seen attempting to sting the newly emerged *B. canadensis*. This behavioral sequence contrasts with that observed with the parasite *S. v. burra*. Workers immediately killed and ate the parasites as they emerged from the cells in the same *V. vulgaris* nest.

Our results agree with Yamane and Yamane (1975) that body size was dependent on the type of cell from which the parasite emerged. Those from reproductive cells were larger than individuals from worker cells. Individuals developed in reproductive cells were 10.4-11.4 mm long with an intertegula distance of 3.0 to 3.4 mm while those from worker cells were 8.5 to 9.5 mm long with an intertegula distance of 2.4 to 2.6 mm. In addition, specimens reared from the small worker cells had 18 antennal segments (with the exception of one which had 18 segments on the left side and 19 on the right side), while those reared from the larger reproductive cells had 19 segments.

Discussion

The rearing of *B. canadensis* from 2 species of *Vespula* combined with reports of its occurring in *V. pensylvanica* (and possible *D. arenaria*) nests shows that this parasite is not host specific. Although a number of yellowjacket species are parasitized, *B. canadensis* is also not very successful as determined by abundance. Sixteen yellowjacket colonies were collected within a 10 mile radius of the infested colonies, but no parasitism was found except in this limited area. This is probably due, at least in part, to the complex life cycle of the parasite, and to its observed performance as a relatively poor flyer. The ability of *B. canadensis* adults to disperse after emergence from a vespine nest is probably quite limited.

Since adult trigonalids emerge late in the year (August-September), it is likely that inseminated females overwinter and deposit their eggs on foliage the following spring. If so, the seasonal cycle of the parasite probably coincides with that of the yellowjacket hosts which initiate colonies in the late spring (April-June).

ACKNOWLEDGMENTS

We thank E.C. Klostermeyer, K. Raffa and L. Corpus for critically reading the manuscript. Steve Woods made many technical assistances during this study.

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